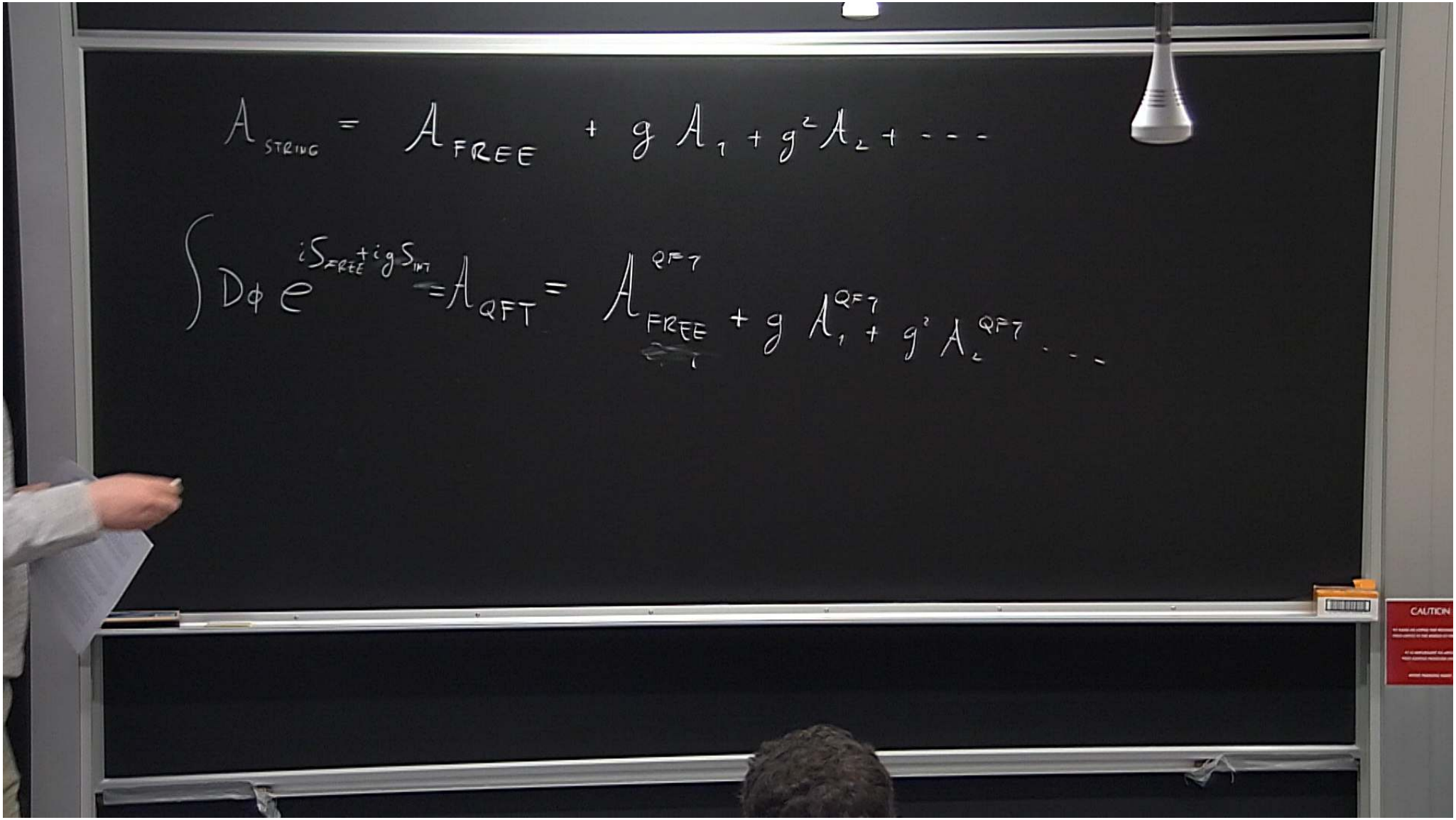
Title: PSI 2018/2019 - String Theory Review - Lecture 1

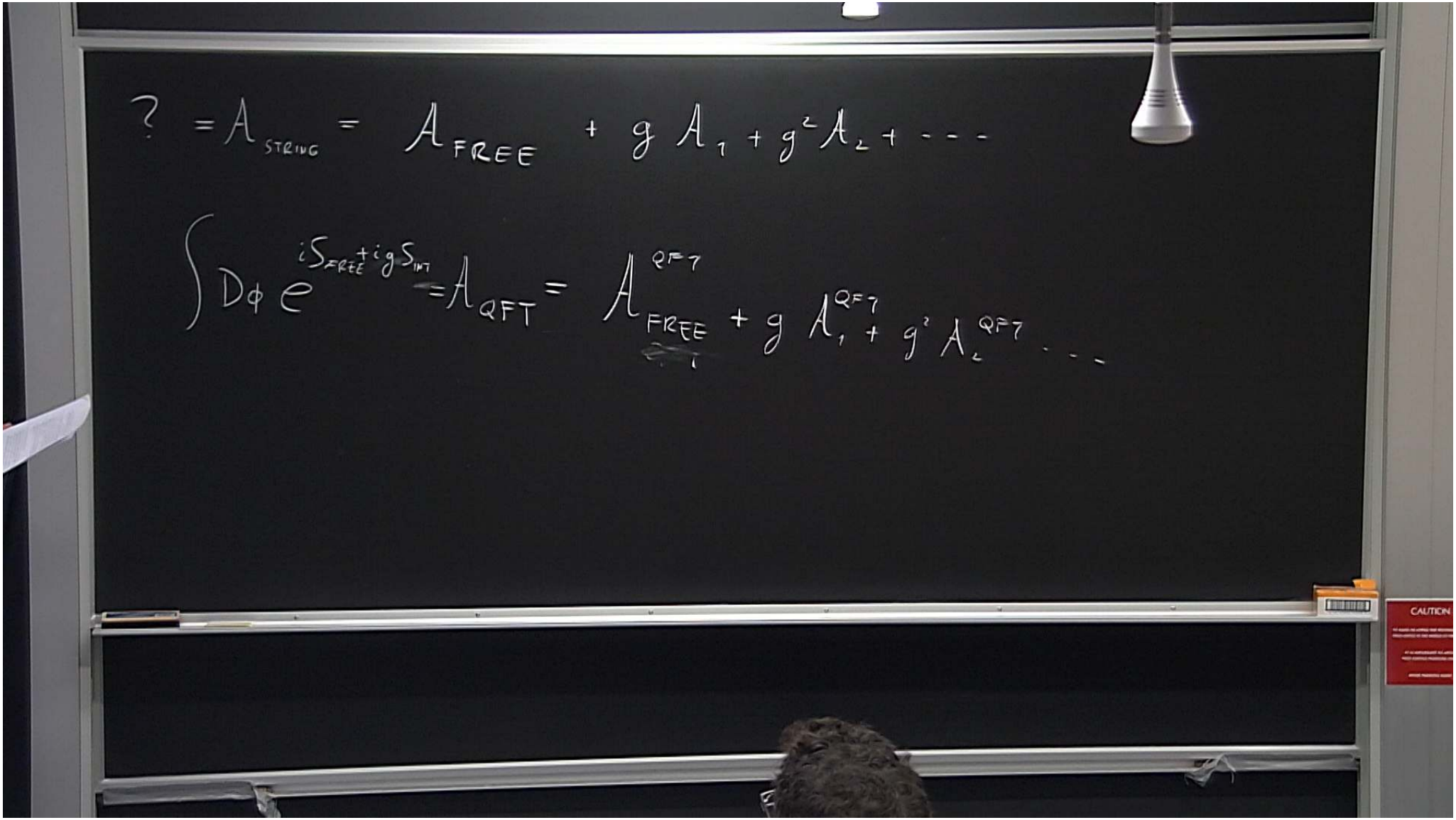
Speakers: Davide Gaiotto

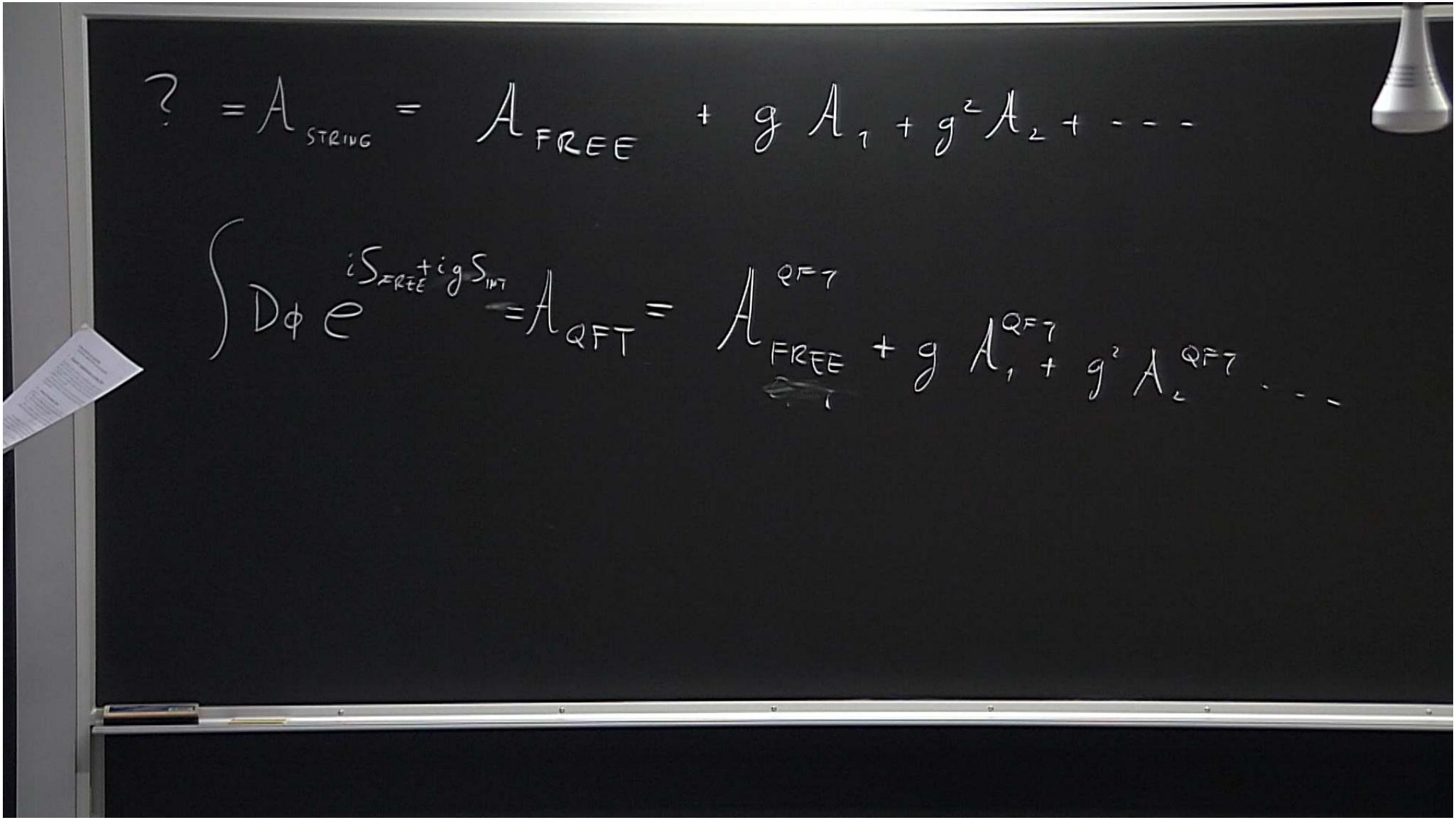
Collection: PSI 2018/2019 - String Theory Review (Gaiotto)

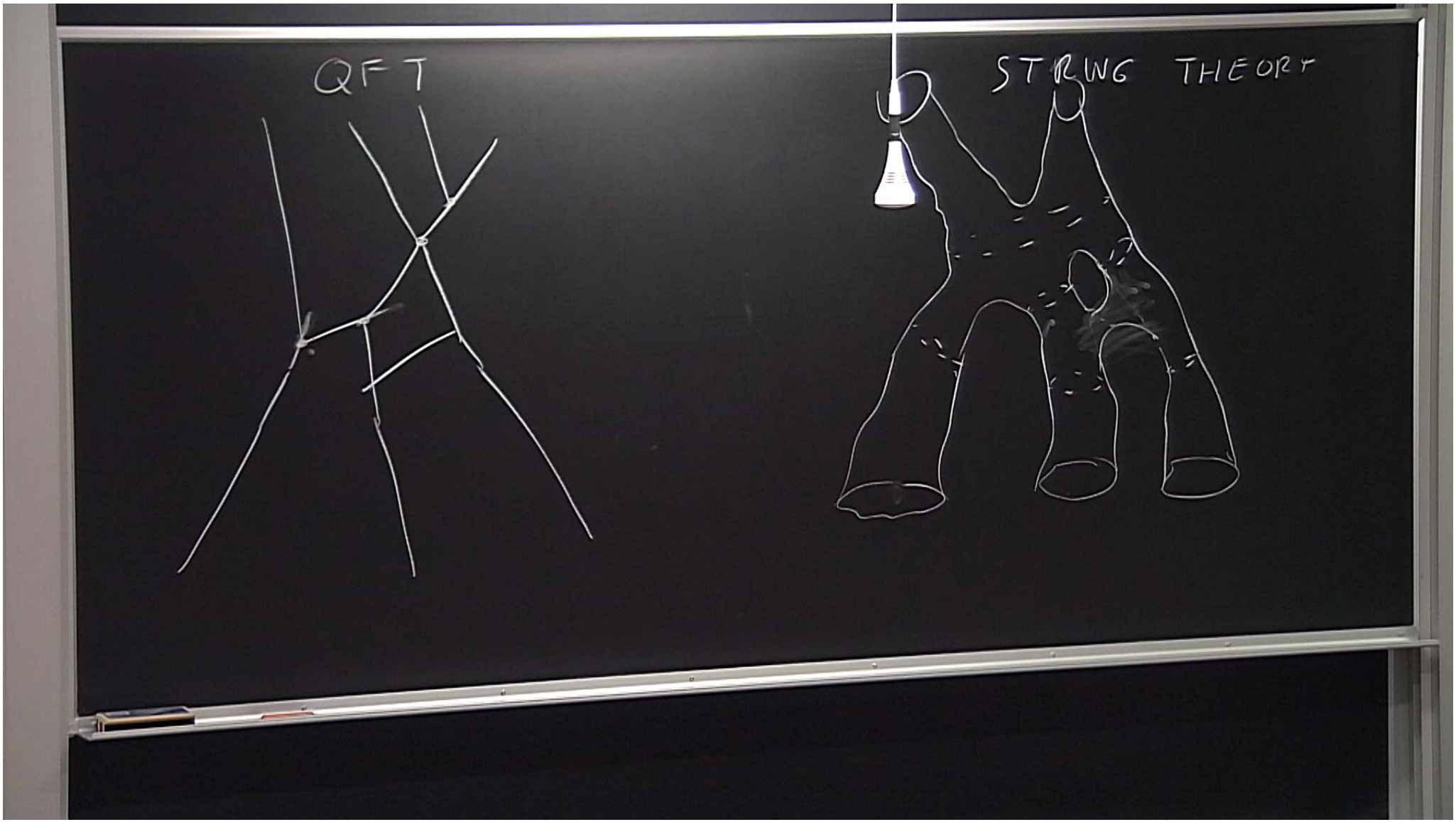
Date: March 25, 2019 - 10:15 AM

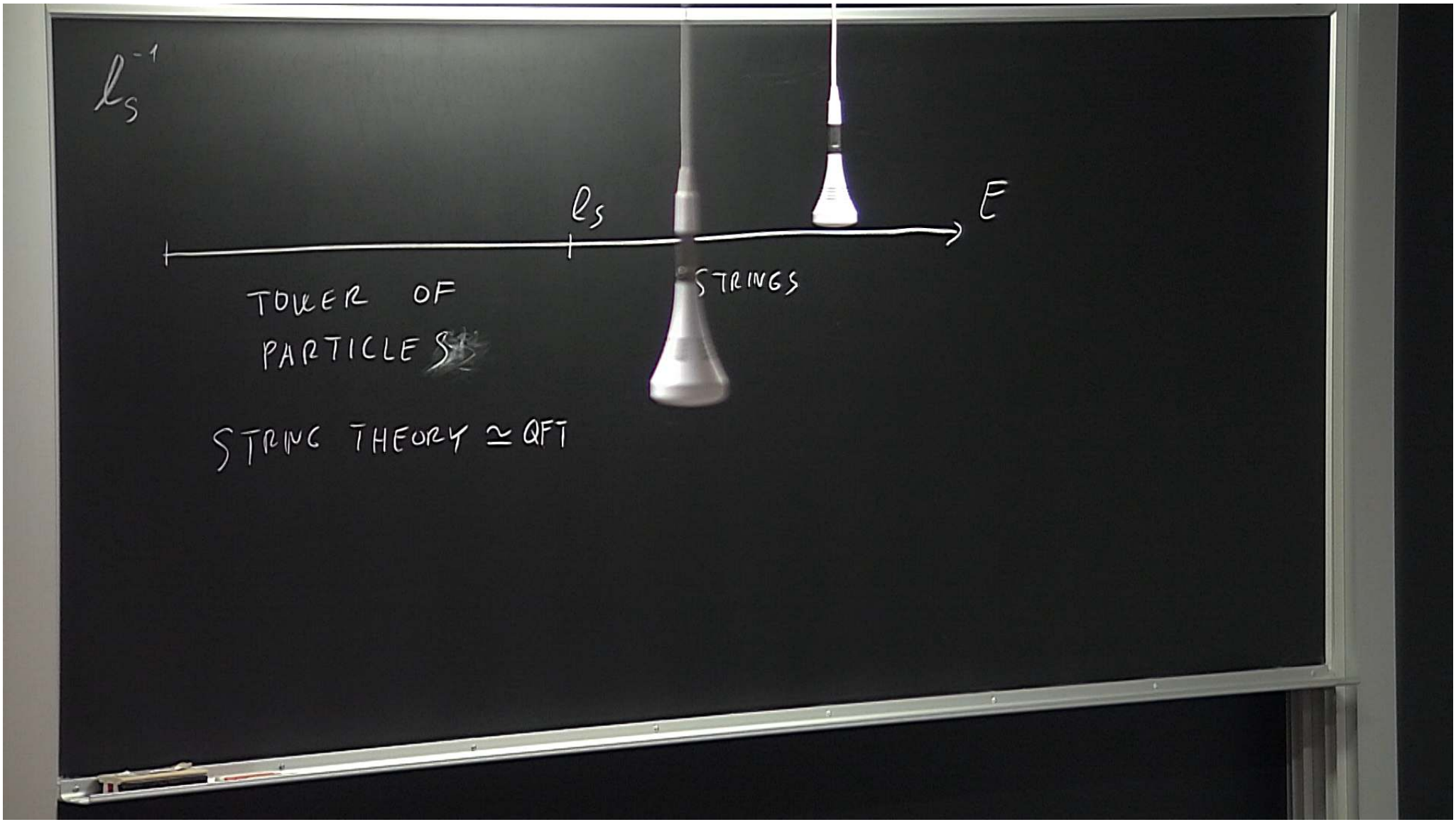
URL: http://pirsa.org/19030083

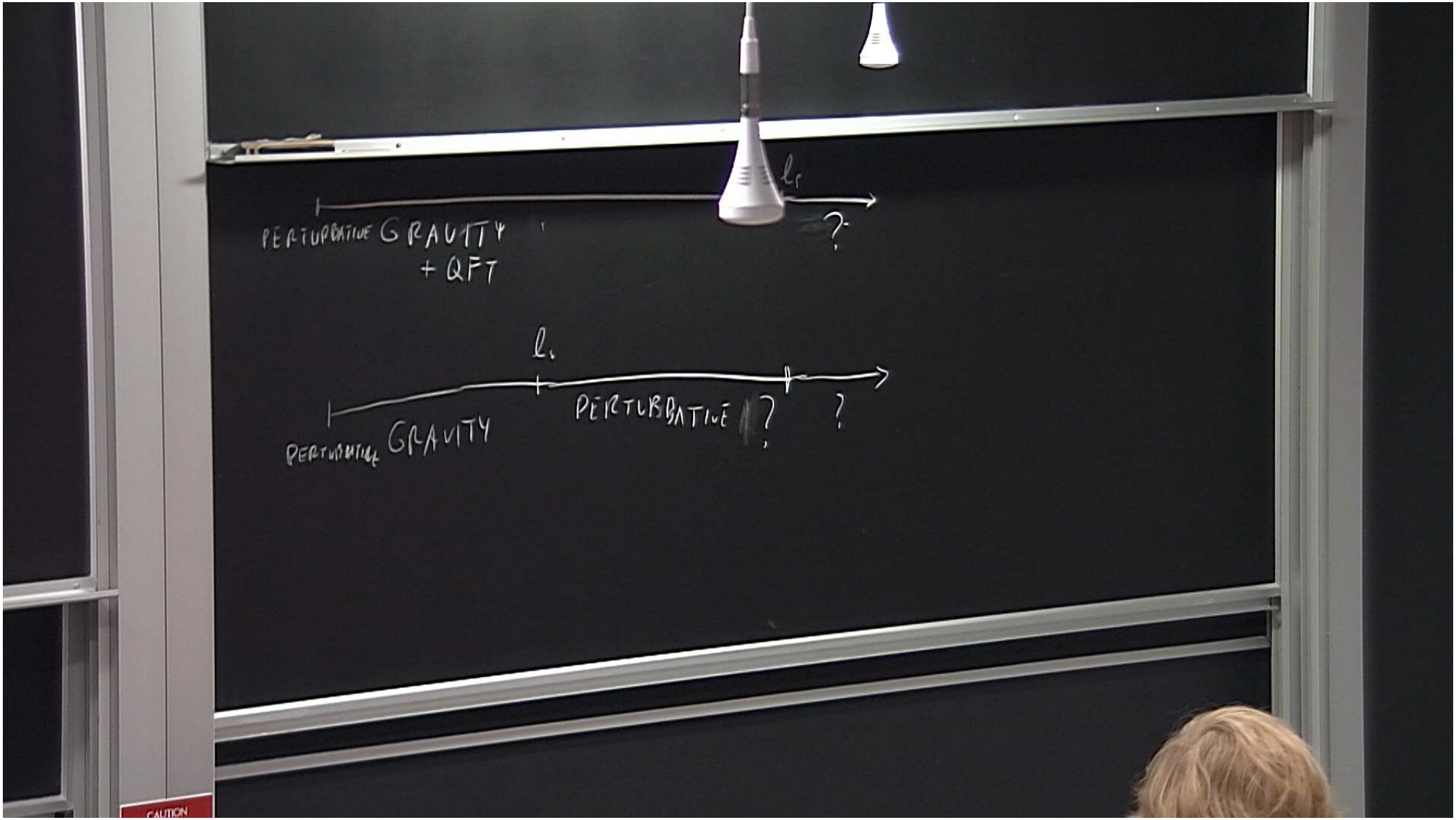

$A_{STRING} = A_{FREE} + g A_1 + g^2 A_2 + \cdots$
$\int D\phi\, e^{iS_{FREE} + igS_{INT}} = A_{QFT} = A^{QFT}_{FREE} + g A^{QFT}_1 + g^2 A^{QFT}_2 \cdots$
CAUTION

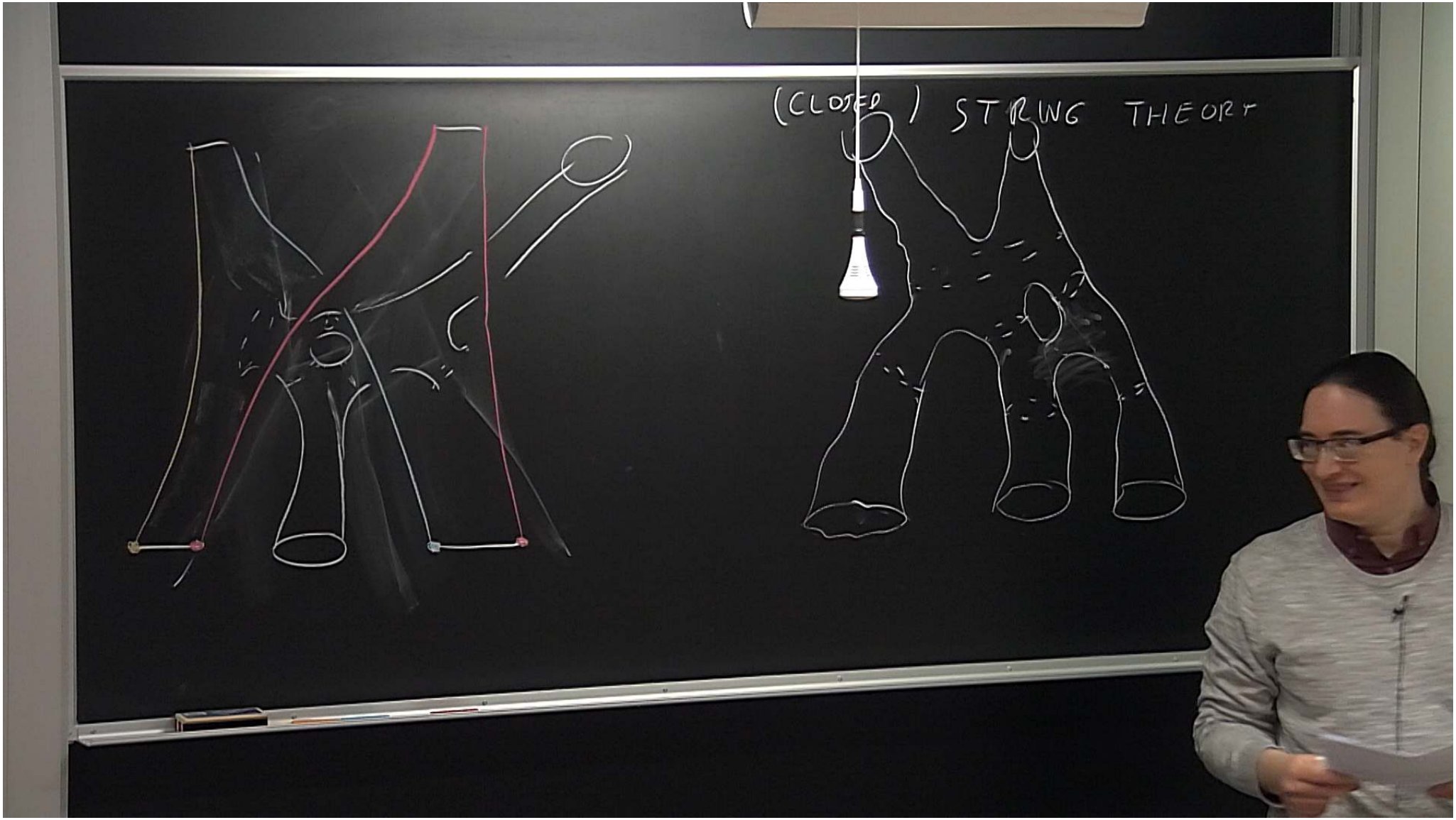

? $= A_{STRING} = A_{FREE} + g A_1 + g^2 A_2 + \cdots$
$\int D\phi\, e^{iS_{FREE} + igS_{INT}} = A_{QFT} = A^{QFT}_{FREE} + g A^{QFT}_1 + g^2 A^{QFT}_2 \cdots$
CAUTION

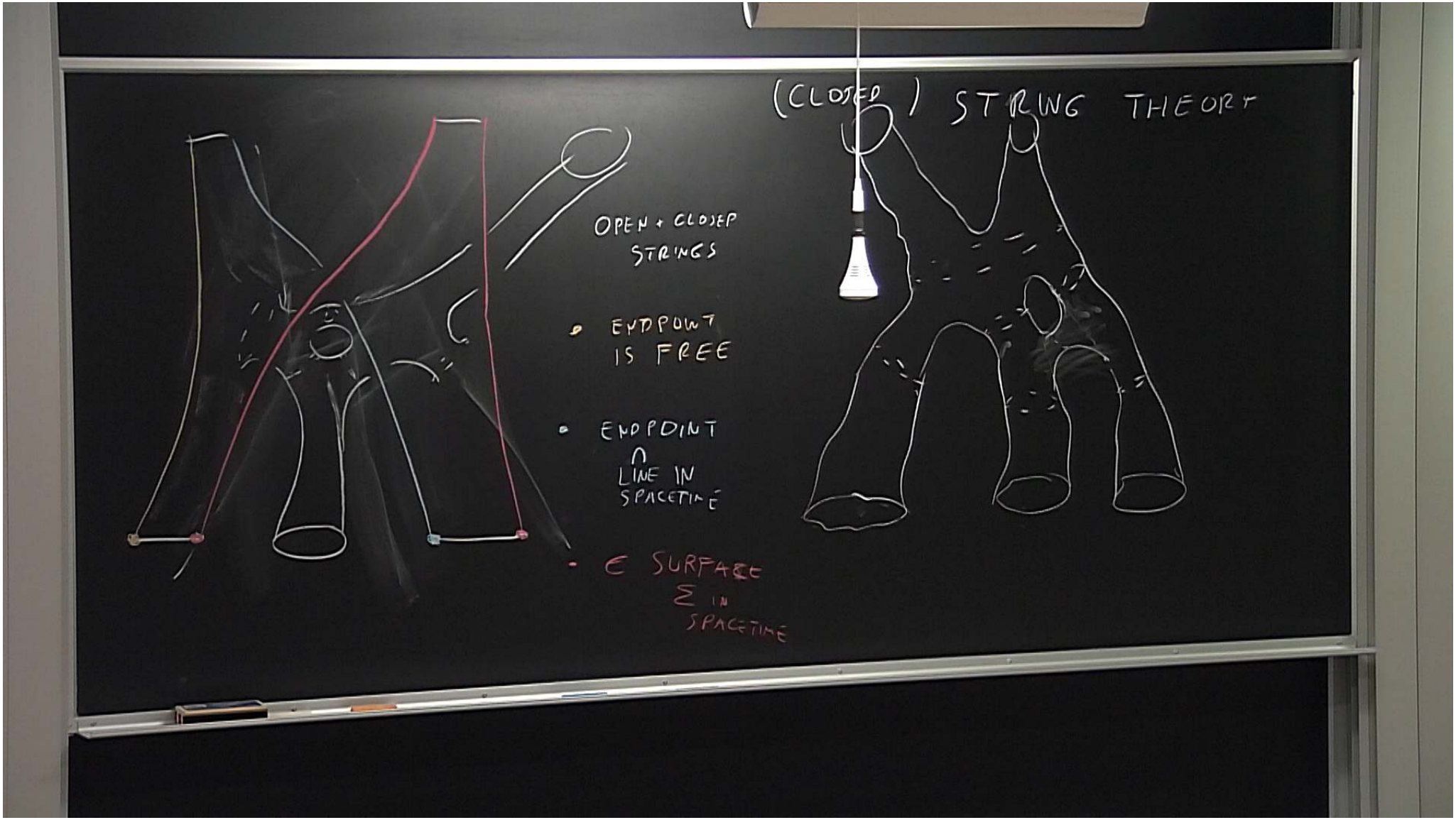

? = A_STRING = A_FREE + g A_1 + g^2 A_2 + ---
∫ Dφ e^{iS_FREE + igS_INT} = A_QFT = A_FREE^QFT + g A_1^QFT + g^2 A_2^QFT ---

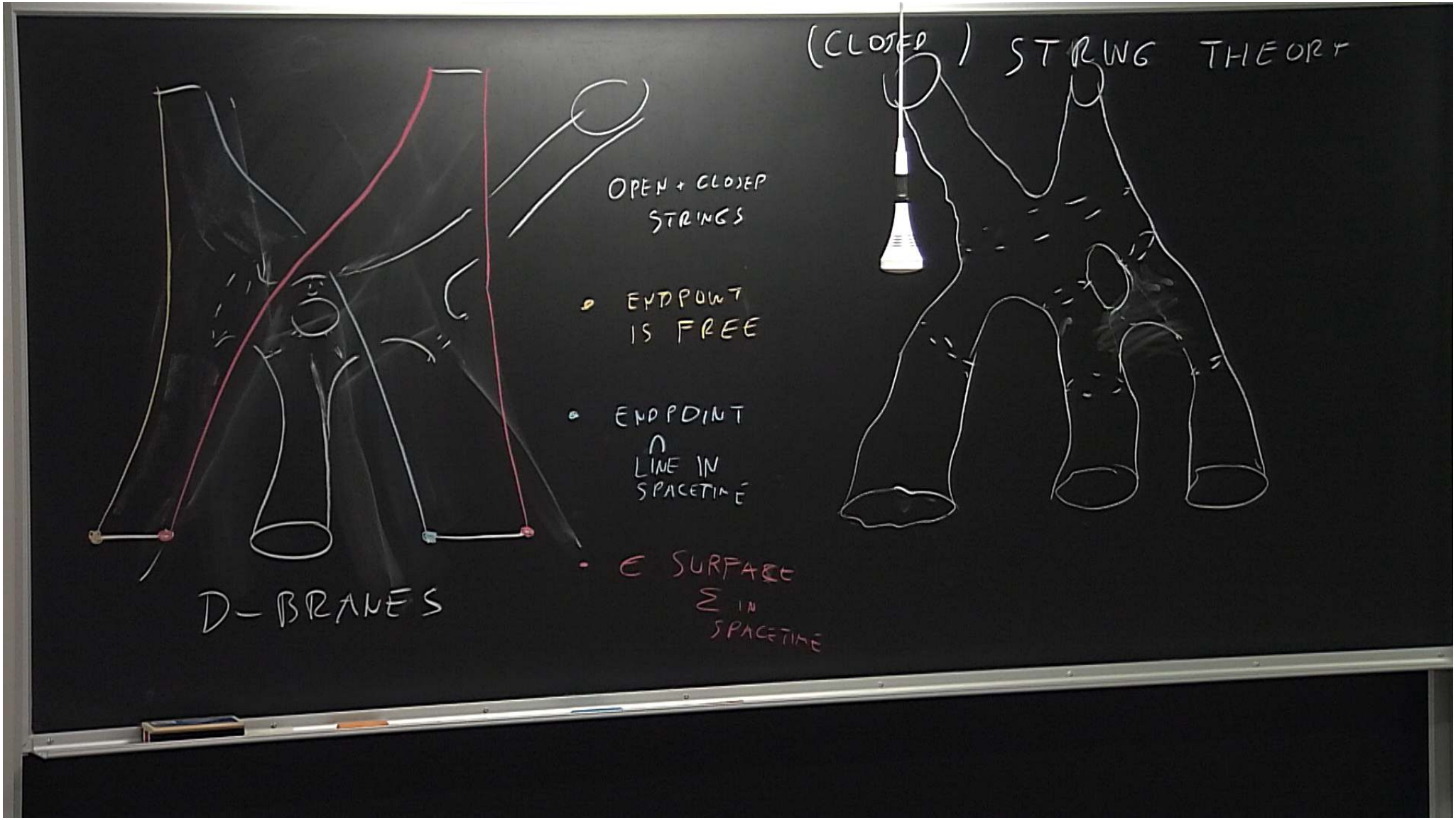

QFT
STRING THEORY

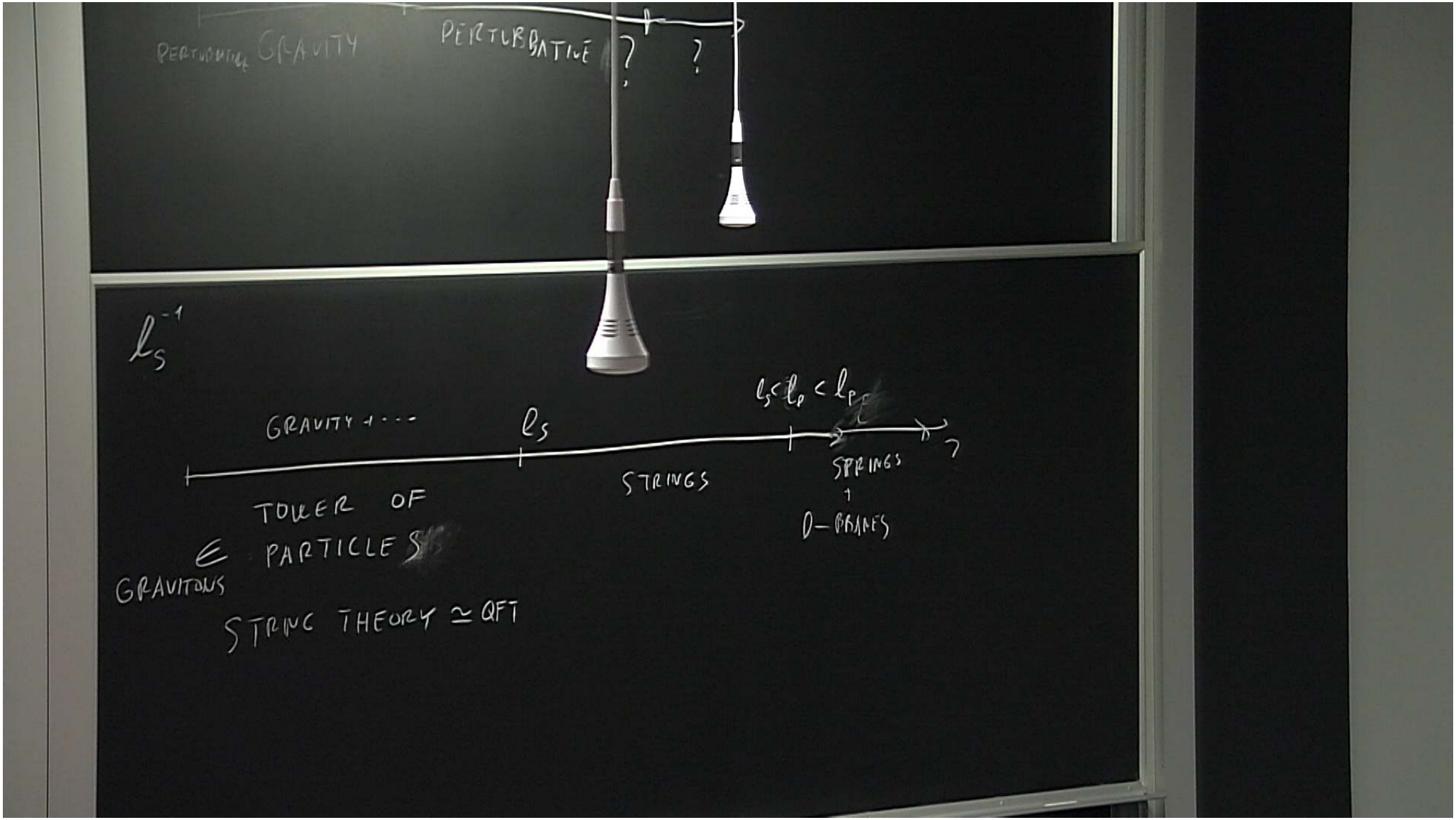

$\ell_s^{-1}$
$\ell_s$
$E$
TOWER OF PARTICLES
STRINGS
STRING THEORY $\simeq$ QFT

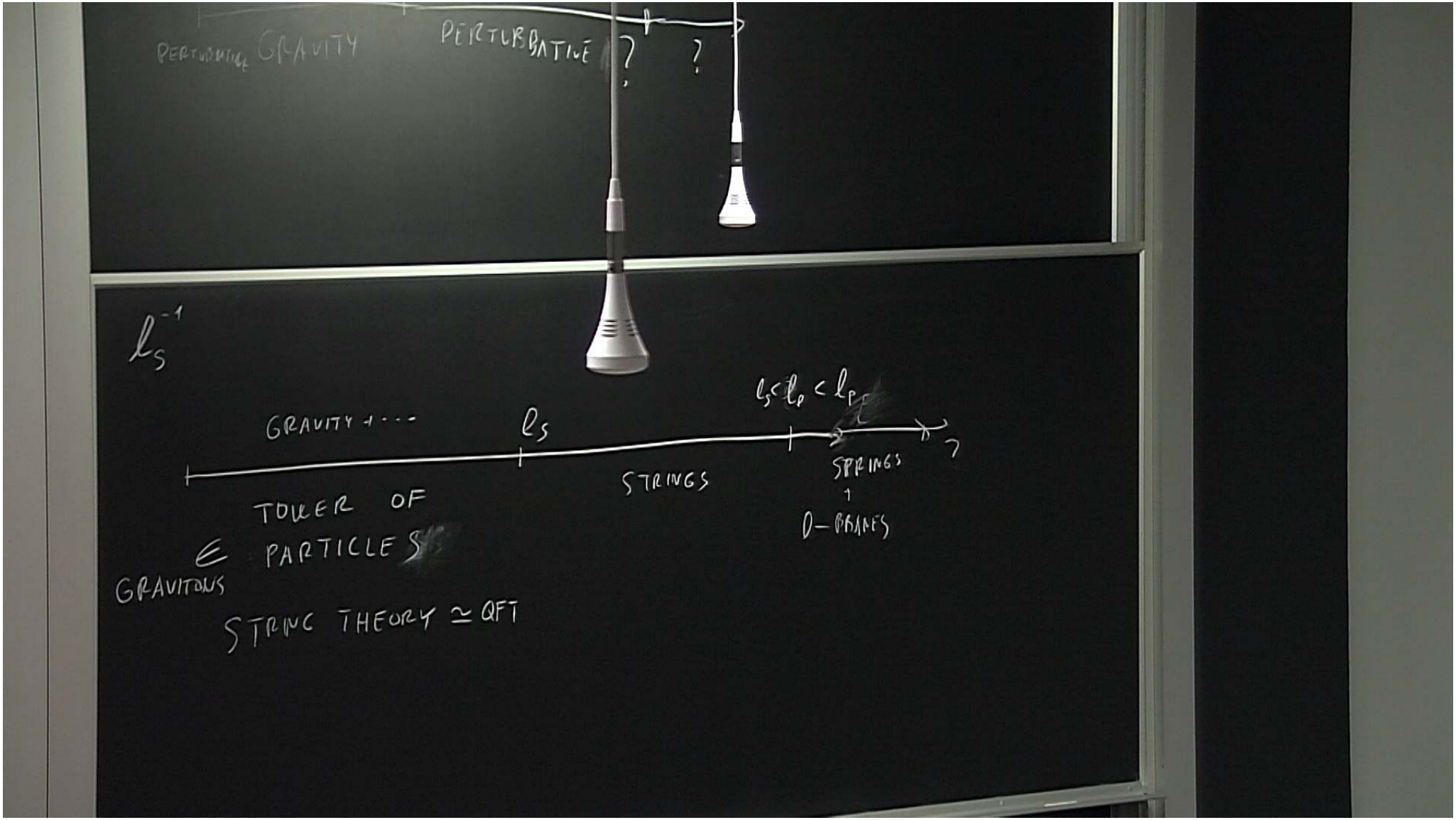

PERTURBATIVE GRAVITY
+ QFT
?
PERTURBATIVE GRAVITY
PERTURBATIVE
?
?

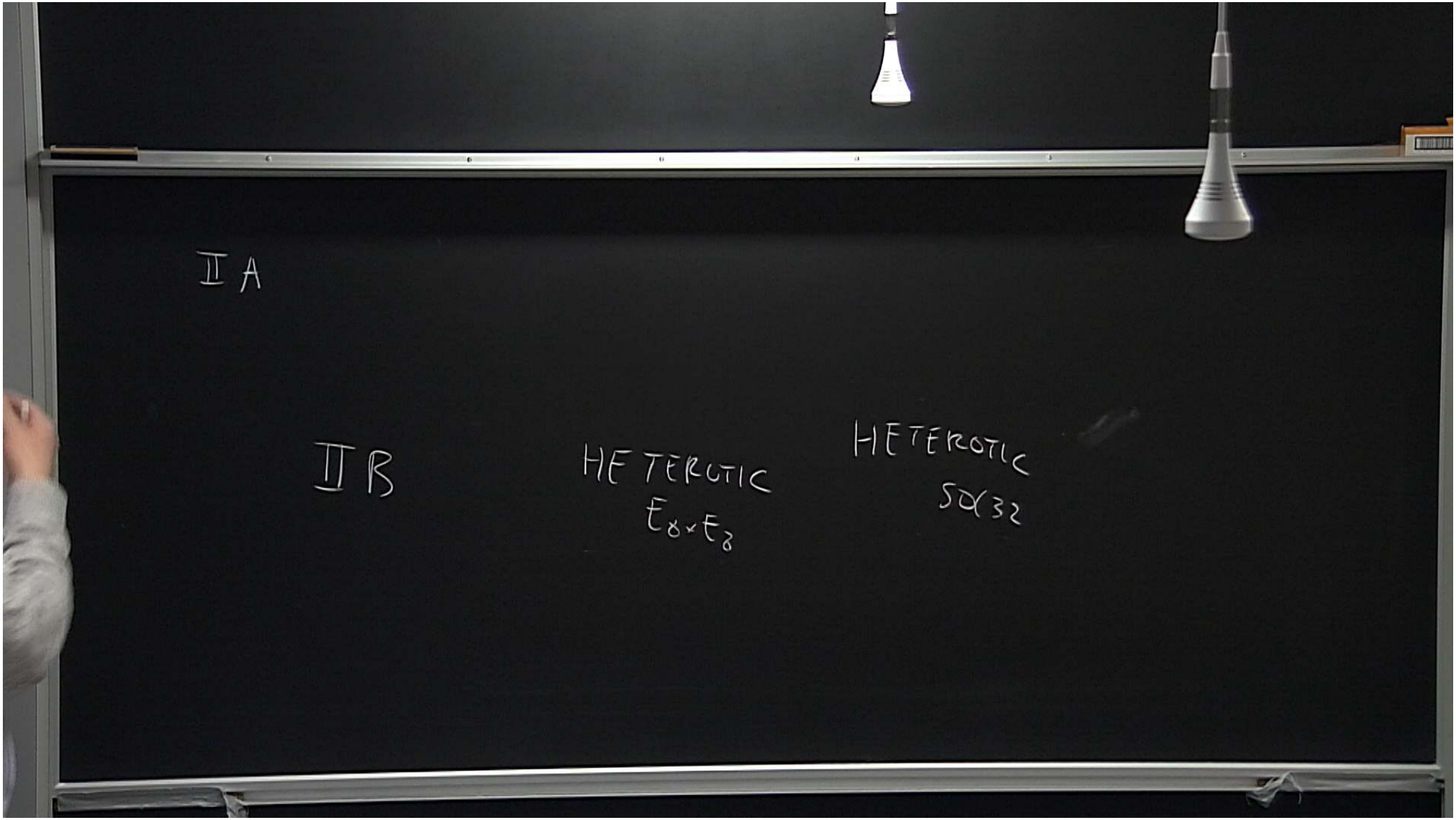

(CLOSED) STRING THEORY

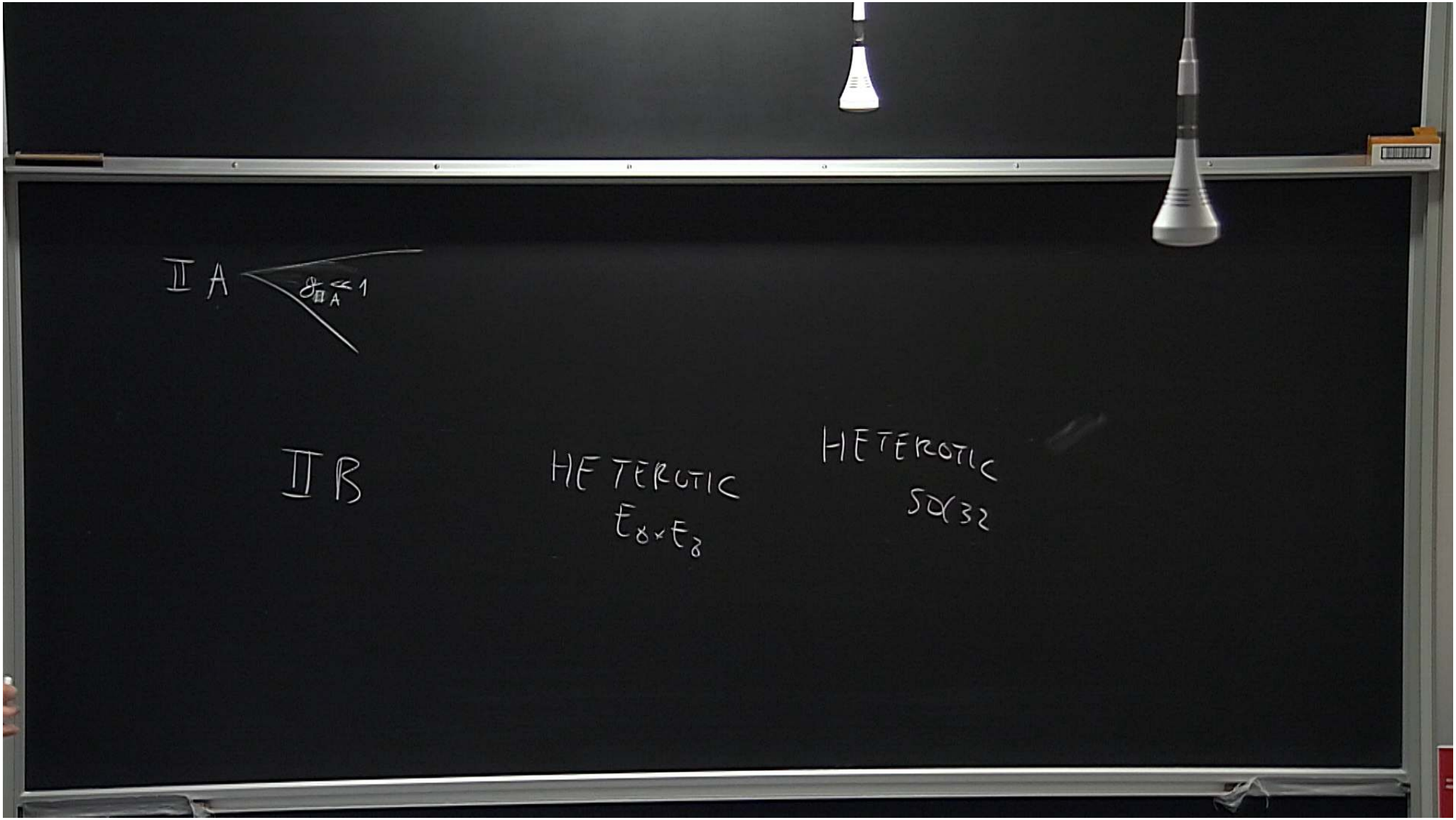

(CLOSED) STRING THEORY
OPEN + CLOSED STRINGS
• ENDPOINT IS FREE
• ENDPOINT ∩ LINE IN SPACETIME
• Σ SURFACE Σ IN SPACETIME

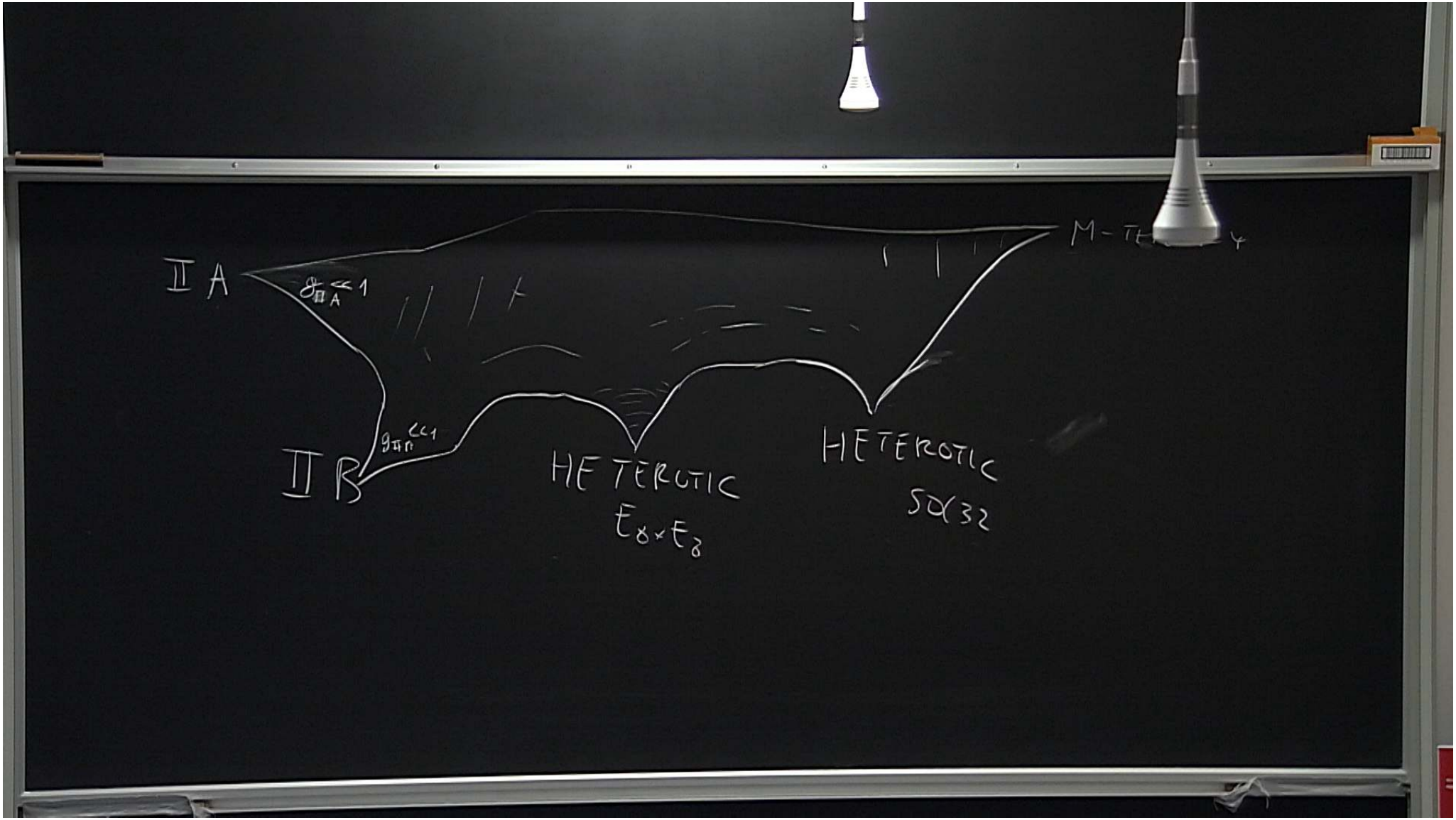

(CLOSED) STRING THEORY
OPEN + CLOSED STRINGS
• ENDPOINT IS FREE
• ENDPOINT ∩ LINE IN SPACETIME
• Σ SURFACE Σ IN SPACETIME
D-BRANES

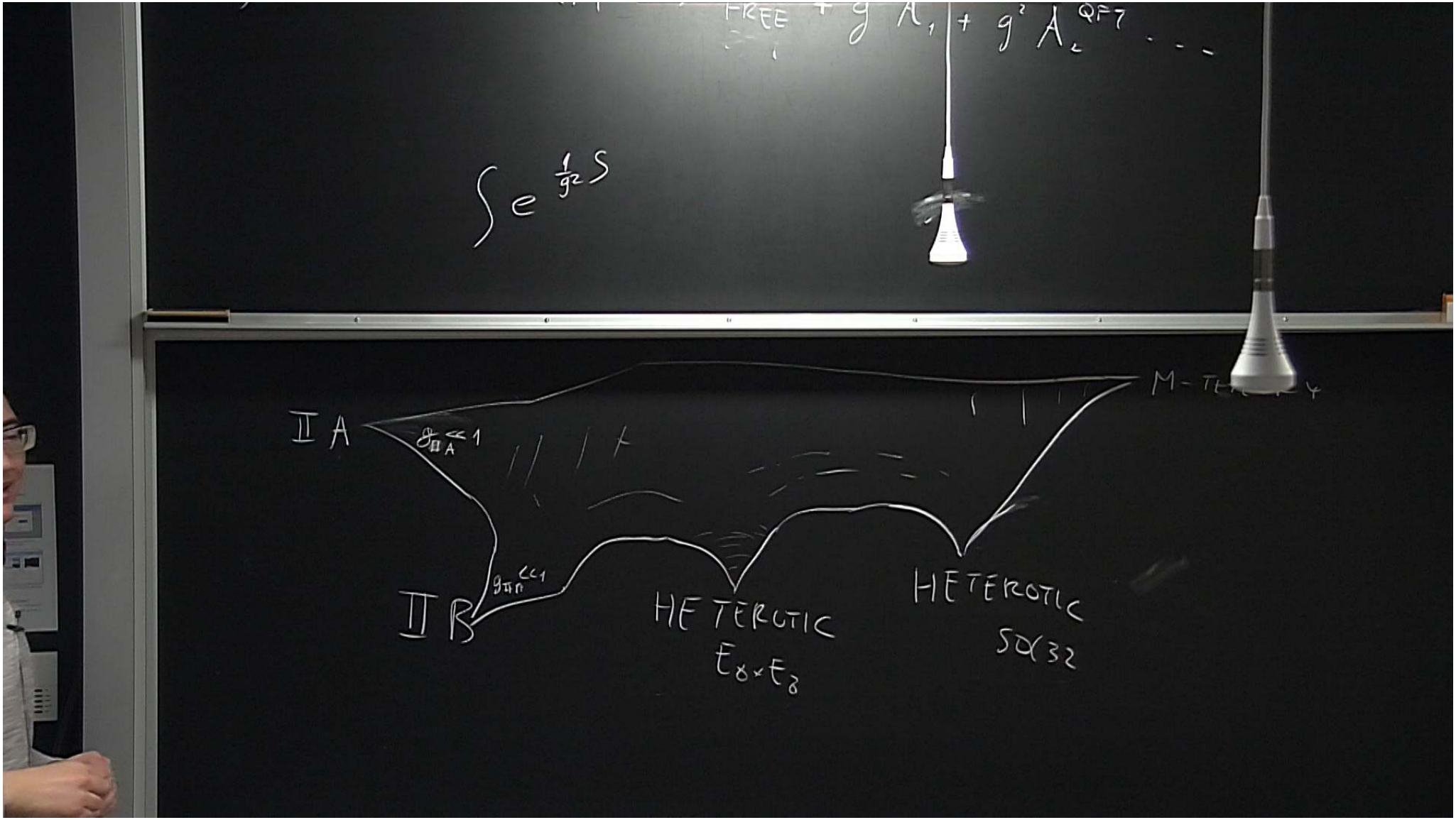

PERTURBATIVE GRAVITY
PERTURBATIVE
?
?
$\ell_s^{-1}$
GRAVITY + ···
$\ell_s$
$\ell_s < \ell_D < \ell_P$
STRINGS
STRINGS + D-BRANES
TOWER OF PARTICLES
GRAVITONS
STRING THEORY ≃ QFT

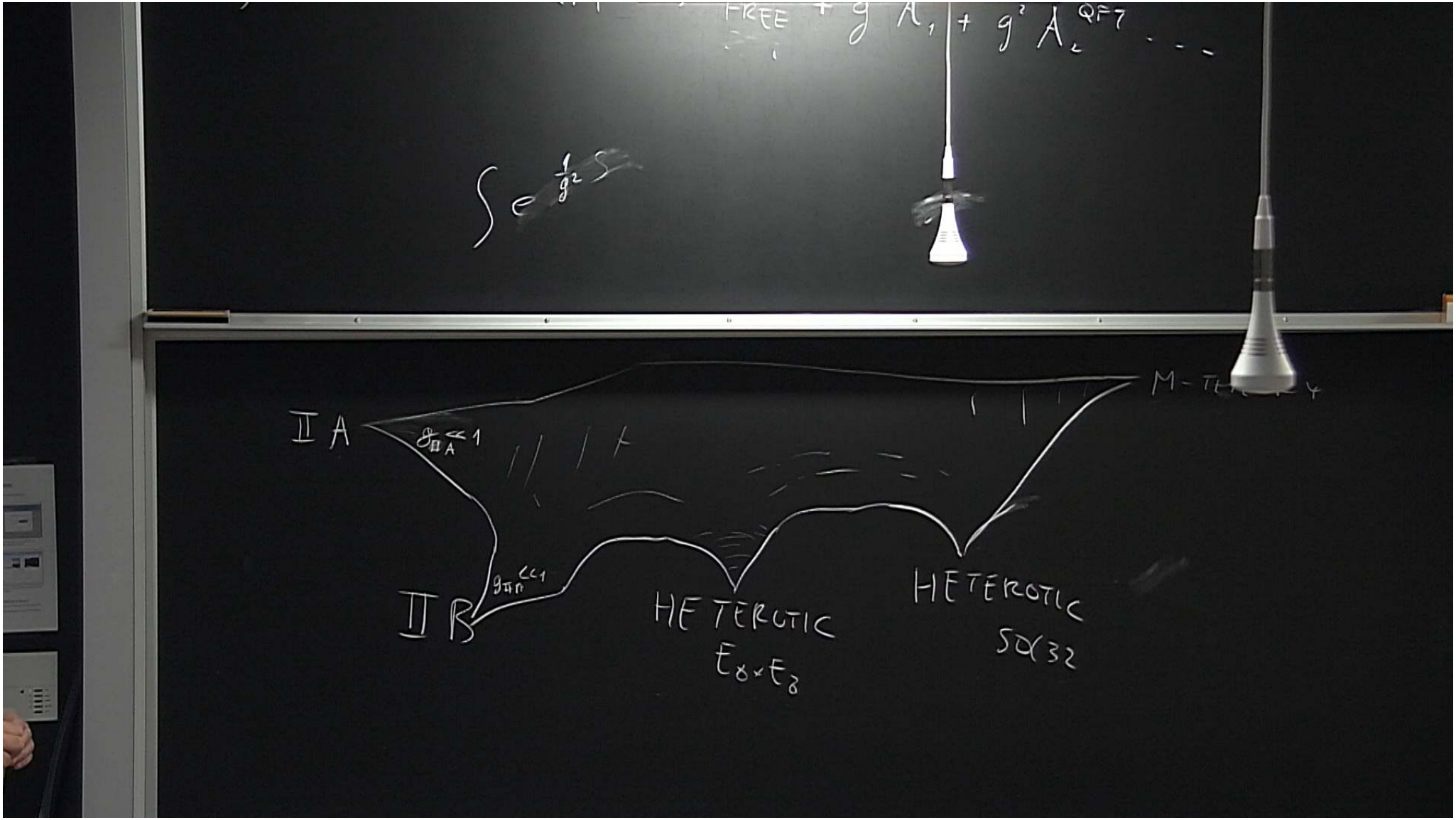

PERTURBATIVE GRAVITY
PERTURBATIVE
?
?
$\ell_s^{-1}$
GRAVITY + ···
$\ell_s$
$\ell_s < \ell_D < \ell_P$
STRINGS
SPRINGS
↑
D-BRANES
TOWER OF
PARTICLES
GRAVITONS
STRING THEORY ≃ QFT

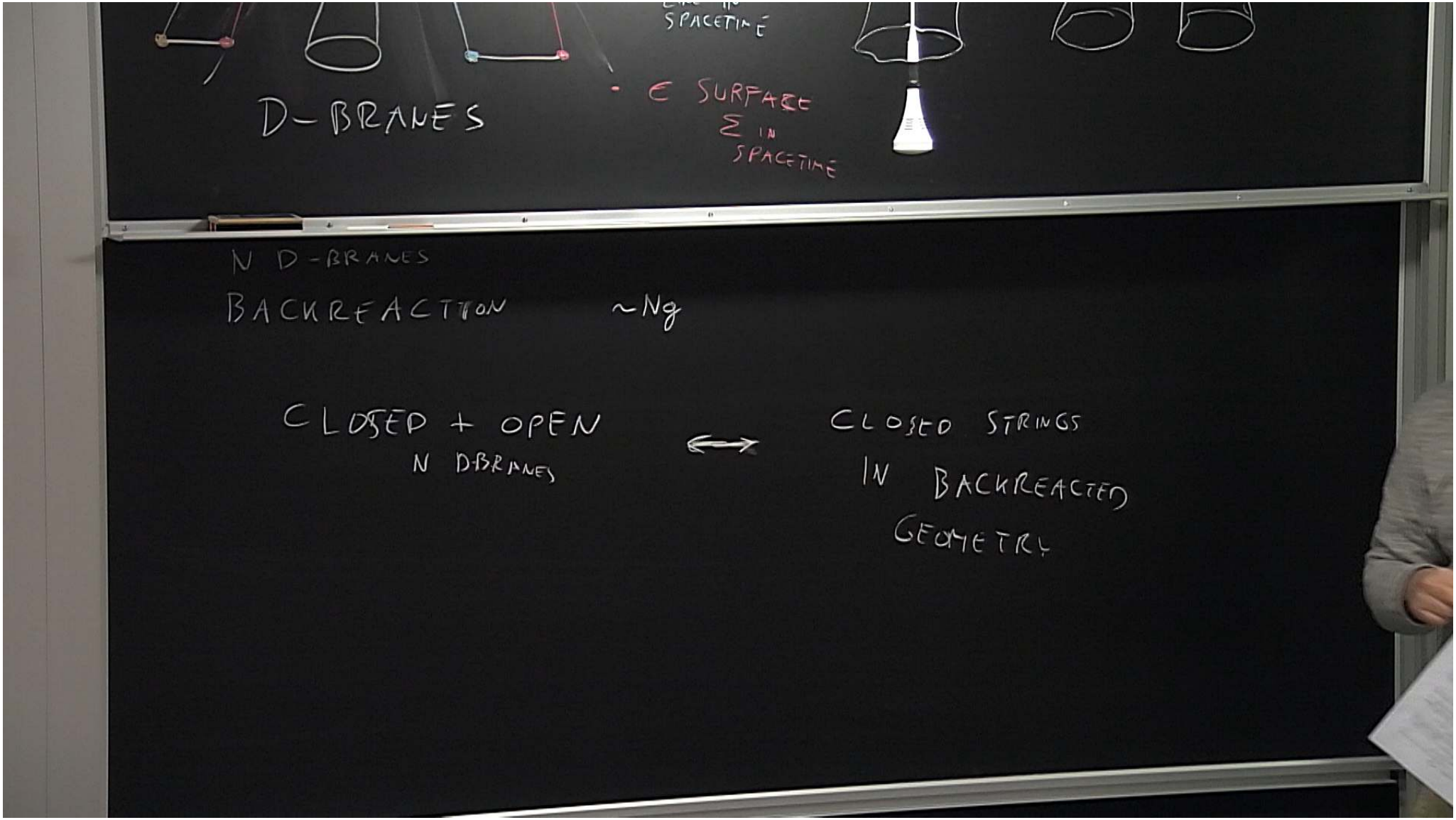

IIA
IIB
HETEROTIC
$E_8 \times E_8$
HETEROTIC
$SO(32)$

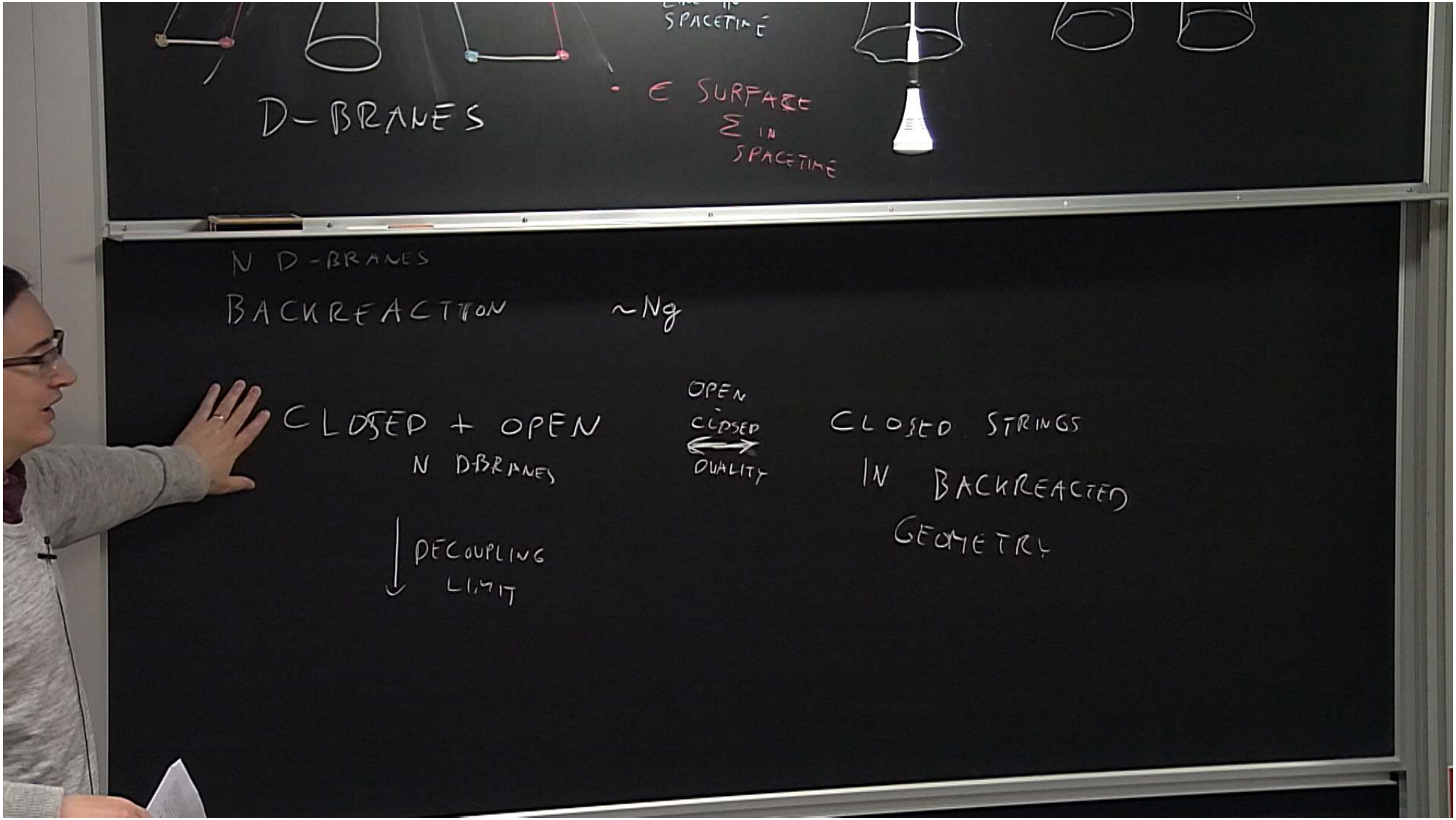

II A
$g_{II_A} \ll 1$
II B
HETEROTIC
$E_8 \times E_8$
HETEROTIC
$SO(32$

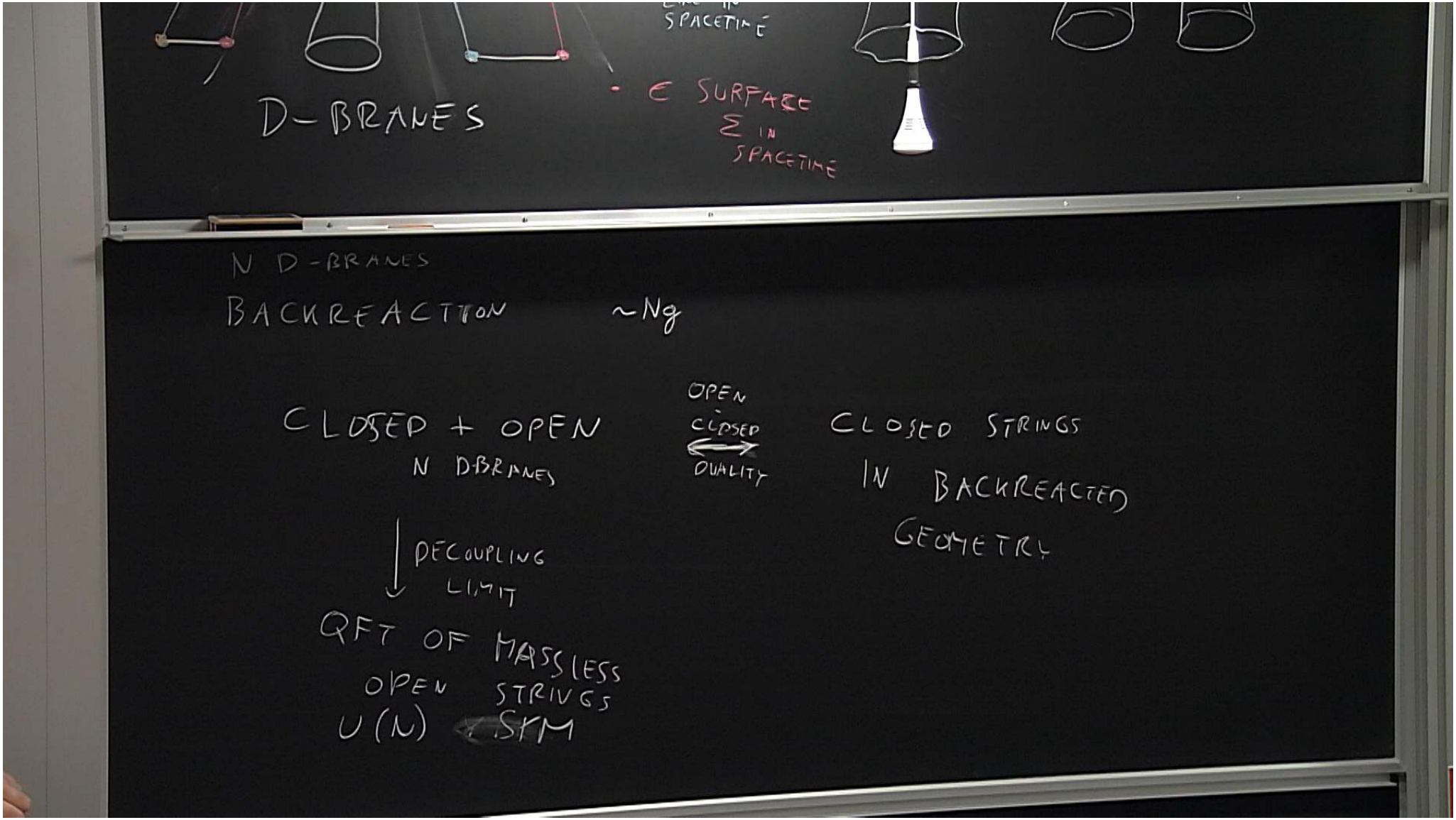

II A
$g_{II_A} \ll 1$
M-THEORY
II B
$g_{II_B} \ll 1$
HETEROTIC
$E_8 \times E_8$
HETEROTIC
$SO(32)$

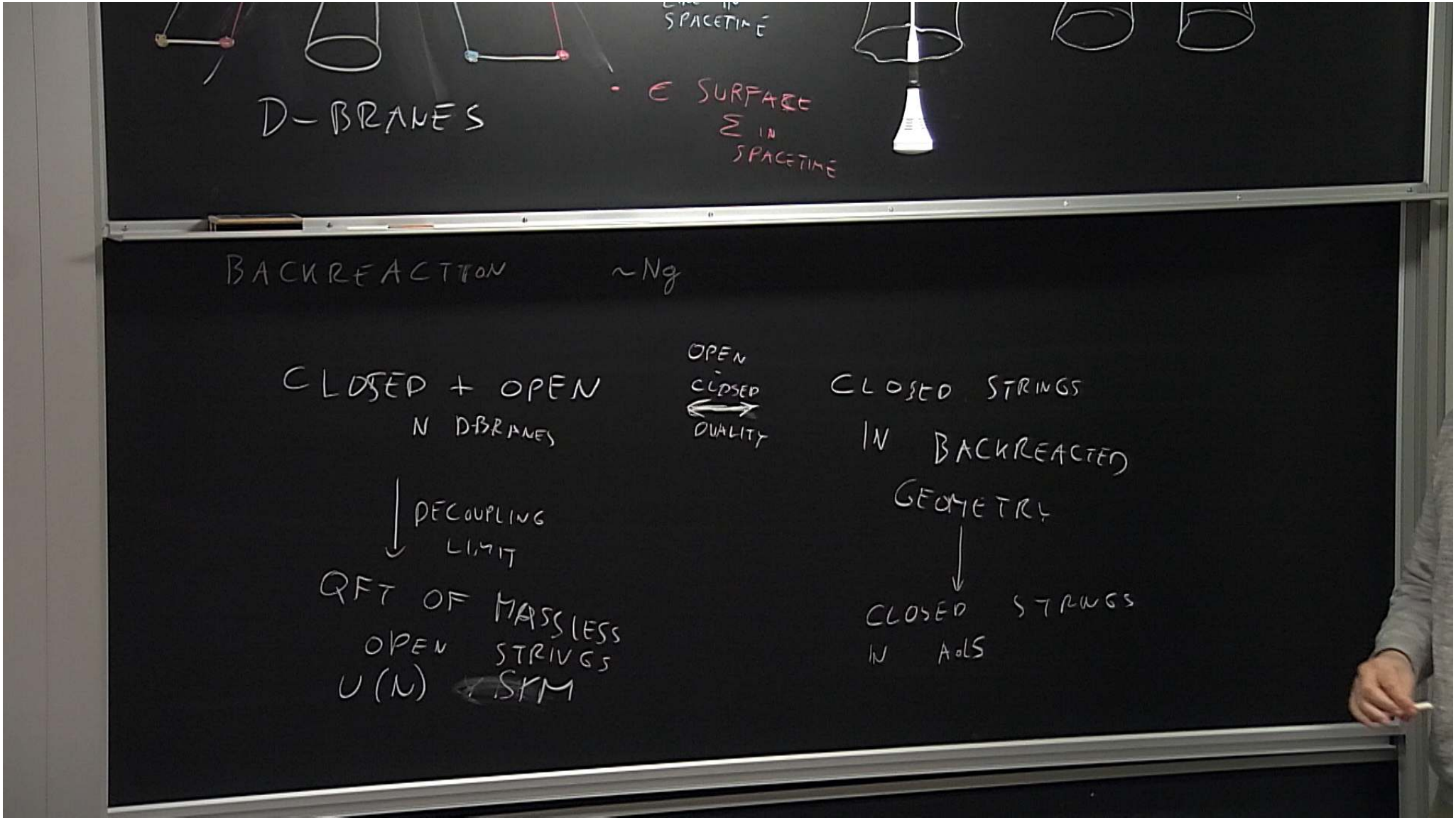

FREE + g A1 + g² A2 QFT . . .
∫ e^(1/g²) S
M-THEORY
II A
g_IIA ≪ 1
II B
g_IIB ≪ 1
HETEROTIC
E8×E8
HETEROTIC
SO(32)

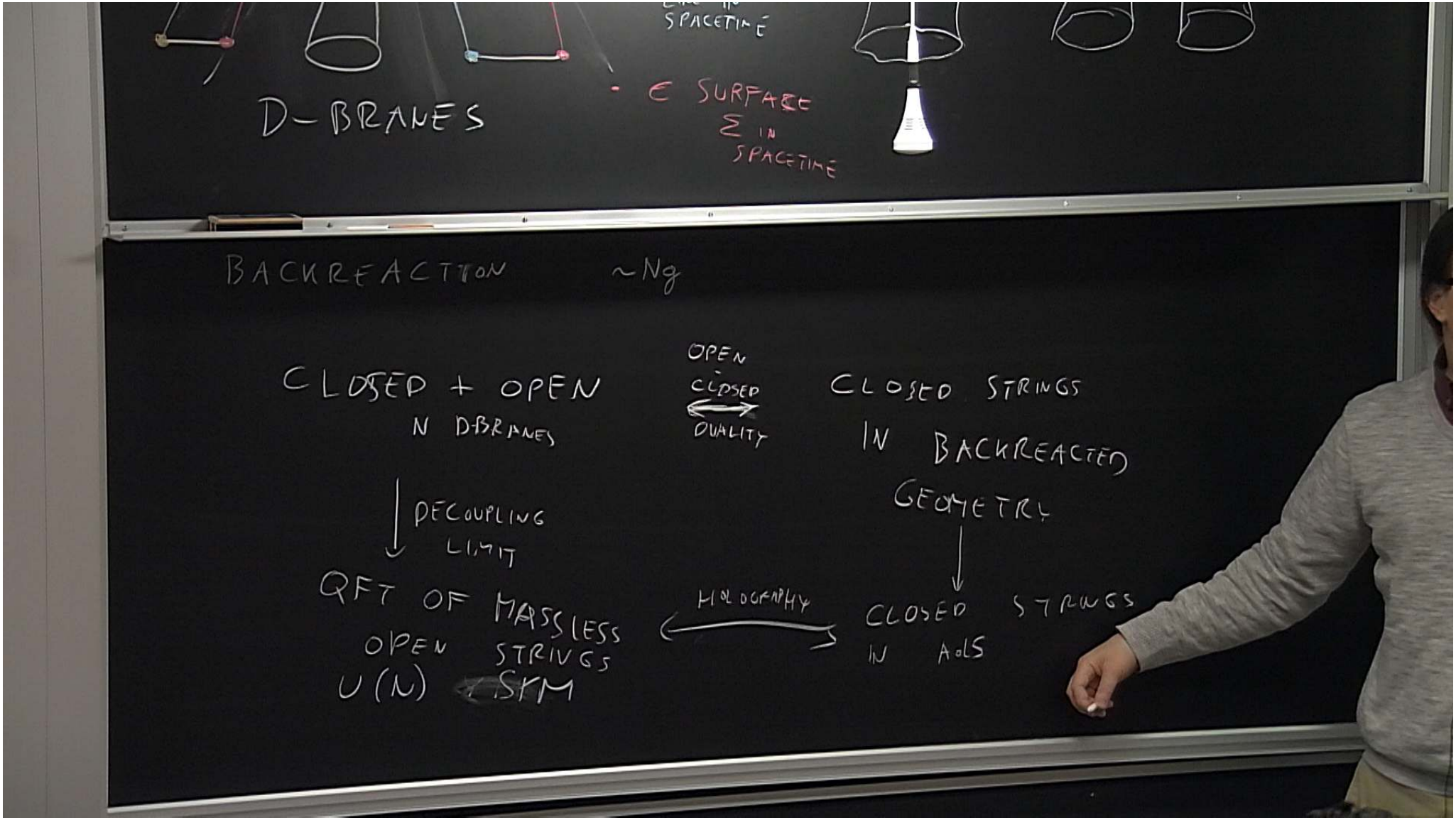

FREE + g A1 + g² A2 QFT ...
Se^(1/g² S)
II A
g_IIA << 1
M-THEORY
II B
g_IIB << 1
HETEROTIC
E8×E8
HETEROTIC
SO(32)


SPACETIME
D-BRANES
Σ SURFACE
Σ IN
SPACETIME
N D-BRANES
BACKREACTION ~Ng
CLOSED + OPEN
N DBRANES
CLOSED STRINGS
IN BACKREACTED
GEOMETRY


SPACETIME
D-BRANES
Σ SURFACE
Σ IN
SPACETIME
N D-BRANES
BACKREACTION ~Ng
CLOSED + OPEN
N DBRANES
DECOUPLING
LIMIT
OPEN
CLOSED
DUALITY
CLOSED STRINGS
IN BACKREACTED
GEOMETRY


SPACETIME
D-BRANES
Σ SURFACE
Σ IN
SPACETIME
N D-BRANES
BACKREACTION ~Ng
CLOSED + OPEN
N D-BRANES
OPEN
CLOSED
DUALITY
CLOSED STRINGS
IN BACKREACTED
GEOMETRY
DECOUPLING
LIMIT
QFT OF MASSLESS
OPEN STRINGS
U(N) SYM


SPACETIME
D-BRANES
Σ SURFACE Σ IN SPACETIME
BACKREACTION ~Ng
CLOSED + OPEN
N D3BRANES
DECOUPLING LIMIT
QFT OF MASSLESS OPEN STRINGS
U(N) SYM
OPEN CLOSED DUALITY
CLOSED STRINGS IN BACKREACTED GEOMETRY
CLOSED STRINGS IN AdS


SPACETIME
D-BRANES
Σ SURFACE
Σ IN
SPACETIME
BACKREACTION ~Ng
CLOSED + OPEN
N D-BRANES
OPEN
CLOSED
DUALITY
CLOSED STRINGS
IN BACKREACTED
GEOMETRY
DECOUPLING
LIMIT
QFT OF MASSLESS
OPEN STRINGS
U(N) SYM
HOLOGRAPHY
CLOSED STRINGS
IN AdS